

## REMARKS/ARGUMENTS

Claims 11-14, 16 and 17 are pending herein.

The drawings were objected to based on cross-hatching. In Fig. 3, the ceramic substrate and the shape-retaining layer are shown in dotted-line cross-hatching, which is appropriate for, e.g., ceramic materials, and the electrodes are shown in solid-line cross-hatching, which is appropriate for, e.g., metallic material. In Figs. 4a - 4c, the photoresist is shown in thin-line, thick-line cross-hatching, which is appropriate for any kind of plastic material, and the stainless mesh and plating layer are shown in solid-line cross-hatching, which is appropriate for metallic materials. Similarly, in the other drawing figures, the features already mentioned are shown in the same respective types of cross-hatching, the photosensitive emulsion film is shown in thin-line, thick-line cross-hatching and the masking film is shown in solid-line cross-hatching.

In Figs. 7a - 7d, the cross-hatched regions correspond to reference numeral 18 in Fig. 6B, i.e., an emulsion film. As noted in the specification on page 15, lines 7-10, the form of the pattern P shown in Fig. 7 is such that the edges of the pattern P formed on the substrate 34 is sharp. Thus, it is possible to form the pattern P highly accurately in accordance with the designed pattern. Fig. 7 is a conceptual view which shows how printing is performed.

Accordingly, it is respectfully submitted that the cross-hatching in the various drawing Figures corresponds with guidelines described in the MPEP for illustrating sections of various materials. Reconsideration and withdrawal of this objection are therefore requested.

In response in the objection to the disclosure, the specification has been amended to refer to "Fig. 7A." Reconsideration and withdrawal of this objection are requested.

Claims 12-16 were rejected under 35 U.S.C. §112, second paragraph. In response, the claims have been amended as set forth above to more particularly define the claimed invention. These amendments include changes to more clearly set forth the *structural* features of the presently claimed circuit board. The subject matter of original claim 15 has been incorporated into claim 14.

The present specification, page 3, lines 8-26 includes a discussion of subject matter encompassed by claim 12. The invention claimed in claim 12 addresses the problem of forming an aligned pattern having a gap which can be smaller than the conventional

limitation of 40  $\mu\text{m}$ , while employing a technique different from that of the prior art. In particular, the present invention enables the provision of a feature which is different from that which can be obtained by conventional production methods, in which it was necessary for adjacent patterns to be separately formed. When adjacent pattern rows were separately formed, the ultimate result was a group of even numbered rows of patterns and a group of odd-numbered rows of patterns, e.g., a series of vertically aligned rectangular-shaped sections, conceptually numbered from left to right or, e.g., a series of concentric circular sections numbered consecutively from the innermost section to the outermost section. Contrary to the prior art, in the present invention, since the entire pattern can be formed by a single screen-printing operation, the average difference between the thickness of even-numbered sections and odd-numbered sections is less than 5% of the average overall pattern thickness, a feature which cannot be achieved by prior art methods. This feature is further discussed in the present specification at page 17, lines 15-25.

Claim 12 further recites that the plurality of screen-printed patterns are formed in an aligned manner on the substrate, a further structural feature.

Each of claims 13, 14 and 16 also recite one or more clear positive structural feature. In particular, claim 13 recites that each of the screen-printed patterns comprises a printing ink material applied on the substrate. Claim 14 recites that the printing ink is not applied to the substrate corresponding to positions on a mask where a plating layer is formed. Thus, the location of the non-pattern areas is a clear and positive feature *of the circuit board*, as recited in amended claim 14. Claim 16 recites that the plurality of screen-printed patterns comprises a single screen-printed layer.

New claim 17 recites that a difference between thicknesses of two adjacent patterns is not more than 5% of an overall average thickness of the pattern.

In addition, the applicants respectfully object to the statements in the Office Action dated March 24, 2003 to the effect that the expression "pattern formed by screen-printing" is purely a process limitation that is not entitled to patentable weight. This phrase in the claims has now been amended to refer to "screen-printed patterns formed on the substrate." Patterns which are "screen-printed" are structurally distinguishable from patterns formed by other methods. Numerous terms of this type (for example, galvanized metals, positive ion-doped semiconductor layers, etc.) indicate processes by which materials are formed, but also define the structure of the completed material. There is no doubt that a term such as "ion-doped"

would be treated as structurally significant in a claim, and "screen-printed" semantically is an analogous type of expression, which is therefore entitled to patentable weight in the present claims.

Further, it is respectfully noted that a cursory search of the U.S. PTO database shows numerous apparatus claims containing the expression "screen-printed" clearly used in a structurally defining manner.

Reconsideration and withdrawal of this rejection are requested.

Claims 11, 12 and 15 were rejected under 35 U.S.C. §103(a) over U.S. Patent No. 6,041,496 (Haq '496) in view of U.S. Patent No. 6,047,893 (Nakata '893).

As noted above, the present invention is directed to a circuit board having features which have previously not been obtained, namely, a circuit board comprising a substrate and a plurality of screen-printed patterns formed on the substrate, wherein a gap between the plurality of screen-printed patterns is not more than 40  $\mu\text{m}$ . As described in the present specification, the prior art screen masks which have used a photosensitive emulsion film applied on a mesh have employed mesh with a width of much more than 40  $\mu\text{m}$ , because the emulsion film is insufficiently supported by a mesh having a width of not more than 40  $\mu\text{m}$ . The circuit board according to the present invention as recited in claim 11 can be obtained by using a screened mask according to the present invention in which the negative pattern section of the mesh has a mesh opening ratio which is smaller than the mesh opening ratio of the positive pattern section. By using such a screen mask, negative pattern sections, in which the emulsion film needs to be formed on the mesh, are sufficiently supported by the mesh due to the smaller mesh opening ratio in those portions of the screen mask.

The March 24, 2003 Office Action contains a statement that Haq '496 discloses a circuit board comprising a pattern formed by screen-printing, the pattern including circuit patterns 70-72 including a resistor, a capacitor or an inductor. The Office Action contains an acknowledgment that Haq '496 fails to disclose a gap of not more than 40  $\mu\text{m}$  between such passive devices.

The Office Action asserts that Nakata '893 discloses wiring patterns having a gap smaller than 40  $\mu\text{m}$ , referring to Nakata '893, column 17, lines 55-65. However, such disclosure relates to use of a laser beam to form grooves, and does not refer to screen-printing. Accordingly, and in view of the difficulties known in the art (as described in the present specification), persons of skill in the art would have had no expectation that Haq '496

could be modified in the manner suggested in the Office Action. Nakata '893, does not even concern screen-printing, and does not provide disclosure which would enable a person skilled in the art to form a screen-printed pattern having such a small gap distance.

The circuit board of the present invention is non-obvious over the cited prior art because it represents the product of a new technique, and the first instance of a screen-printed article which enables a minute gap distance of not more than 40  $\mu\text{m}$ . None of the cited prior art references suggest that such a feature would have even been possible, much less to actually disclose a circuit board having this feature.

The present invention enables a circuit board having a physically minute gap distance between *screen-printed* patterns formed on a substrate, which has heretofore been unattainable by conventional screen-printing processes. The present applicant is entitled not only to claims to the inventive method, but also to claims to the product having this important property.

Accordingly, reconsideration and withdrawal of this rejection are requested.

In view of the above, claims 10-14, 16 and 17 are in condition for allowance.

If the Examiner believes that contact with Applicant's attorney would be advantageous toward the disposition of this case, the Examiner is herein requested to call Applicant's attorney at the phone number noted below.

The Commissioner is hereby authorized to charge any additional fees associated with this communication or credit any overpayment to Deposit Account No. 50-1446.

Respectfully submitted,



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Date

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